Effects of Wood-burning on Indoor Air Quality (PM10)

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Indoor PM10 in HUA

- Obj 1:
  - Indoor AQ Guidelines
- Obj 2:
  - Source-Exposure apportionment
  - Exposure determinants
  - Health risk assessment
  - Errors associated with ignoring it
- Obj 3:
  - Co-management of heating/energy/GHG issues
- NZ:
  - Wood-burning
  - Damp, leaky homes
  - High rates of cardio-respiratory disease

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Indoor PM10 in wood-burning homes

- Christchurch - regular exceedences of NES for PM10 – mainly due to domestic wood-burning
- But what happens inside?
- What is the effect of wood-burner change-over?
- What are the sources?
  - Own wood-burner (infiltration)
  - Own wood-burner (leakage)
  - Others' wood-burners
  - Other indoor sources

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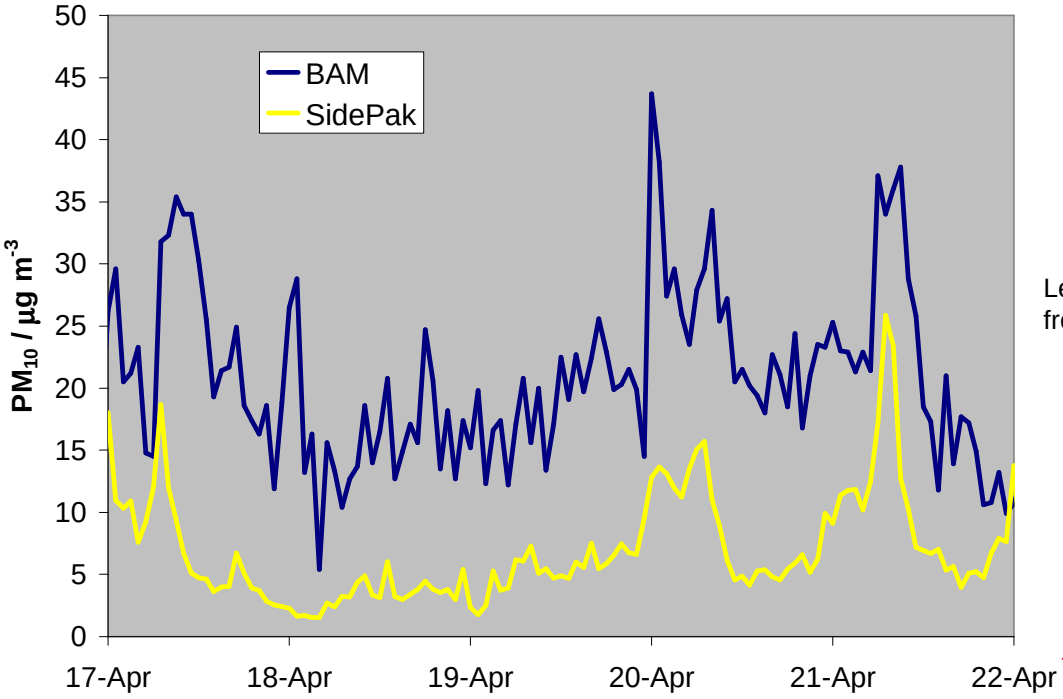
Instrument

TSI AM510 “SidePak”
Integrating nephthelometer

Factory calibration and humidity effects leads to values 3 – 4 times lower than BAM



Left: sample of NIWA intercomparison data from roadside site

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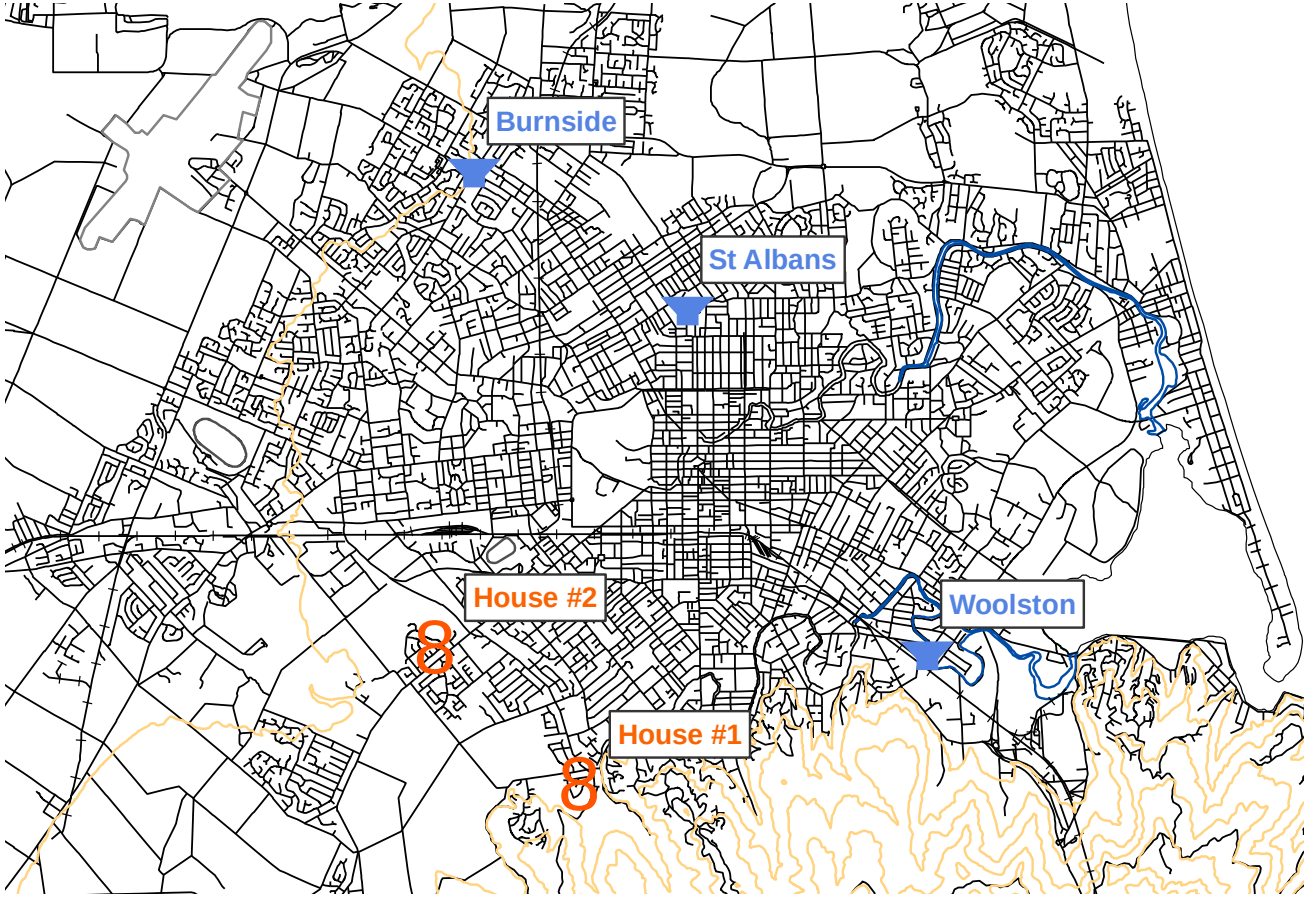
Sites



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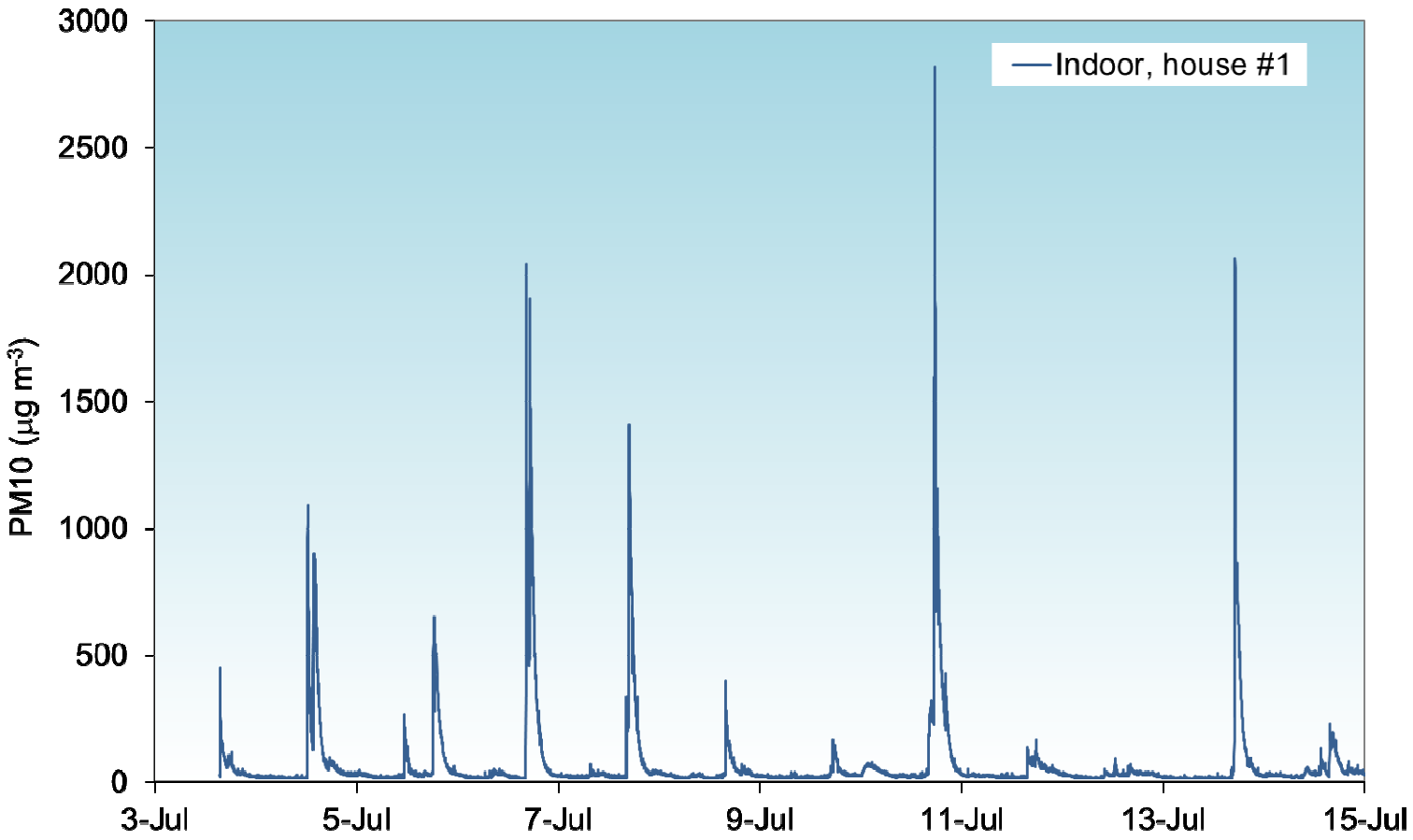
General pattern at House #1



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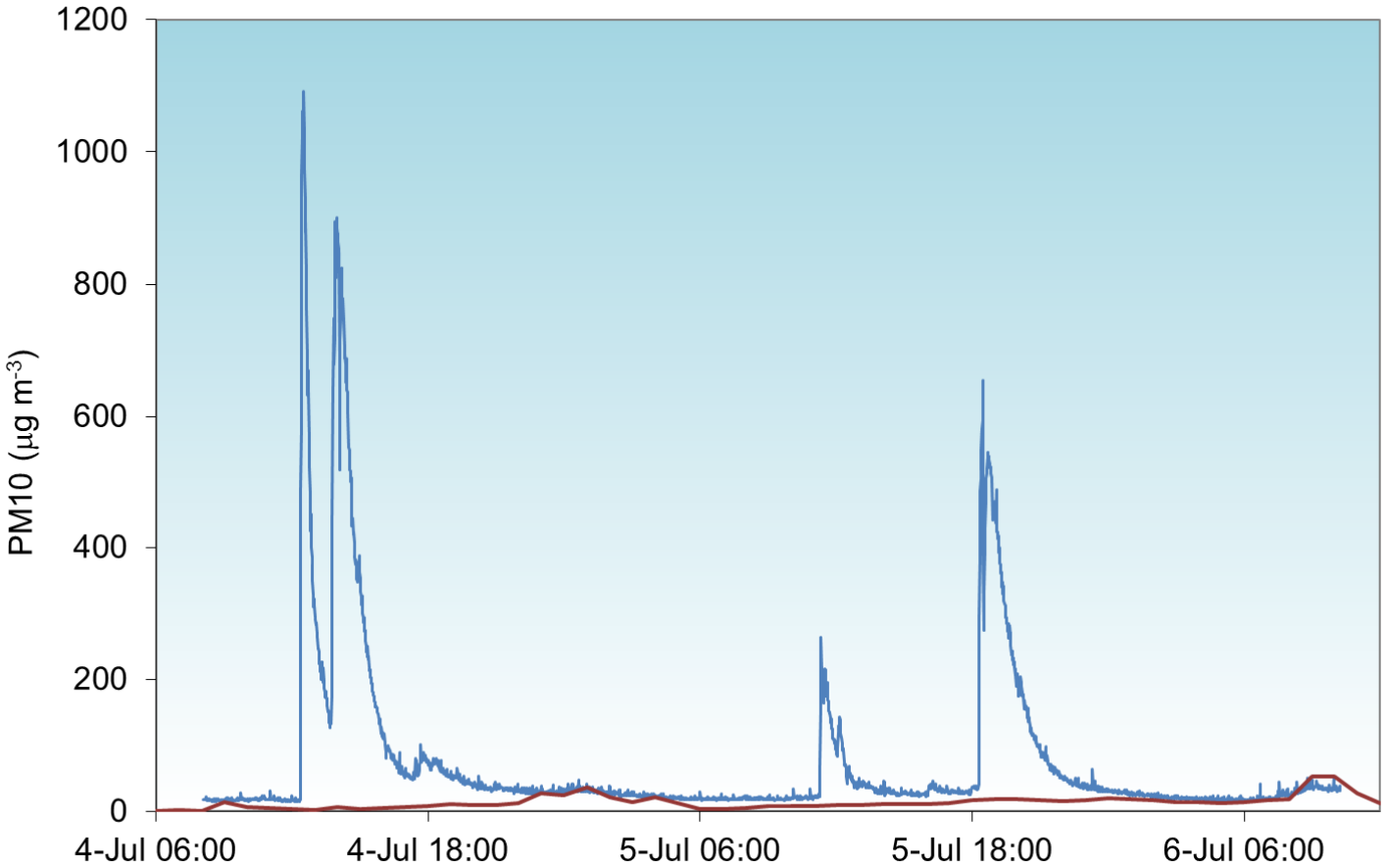
Compared to ambient



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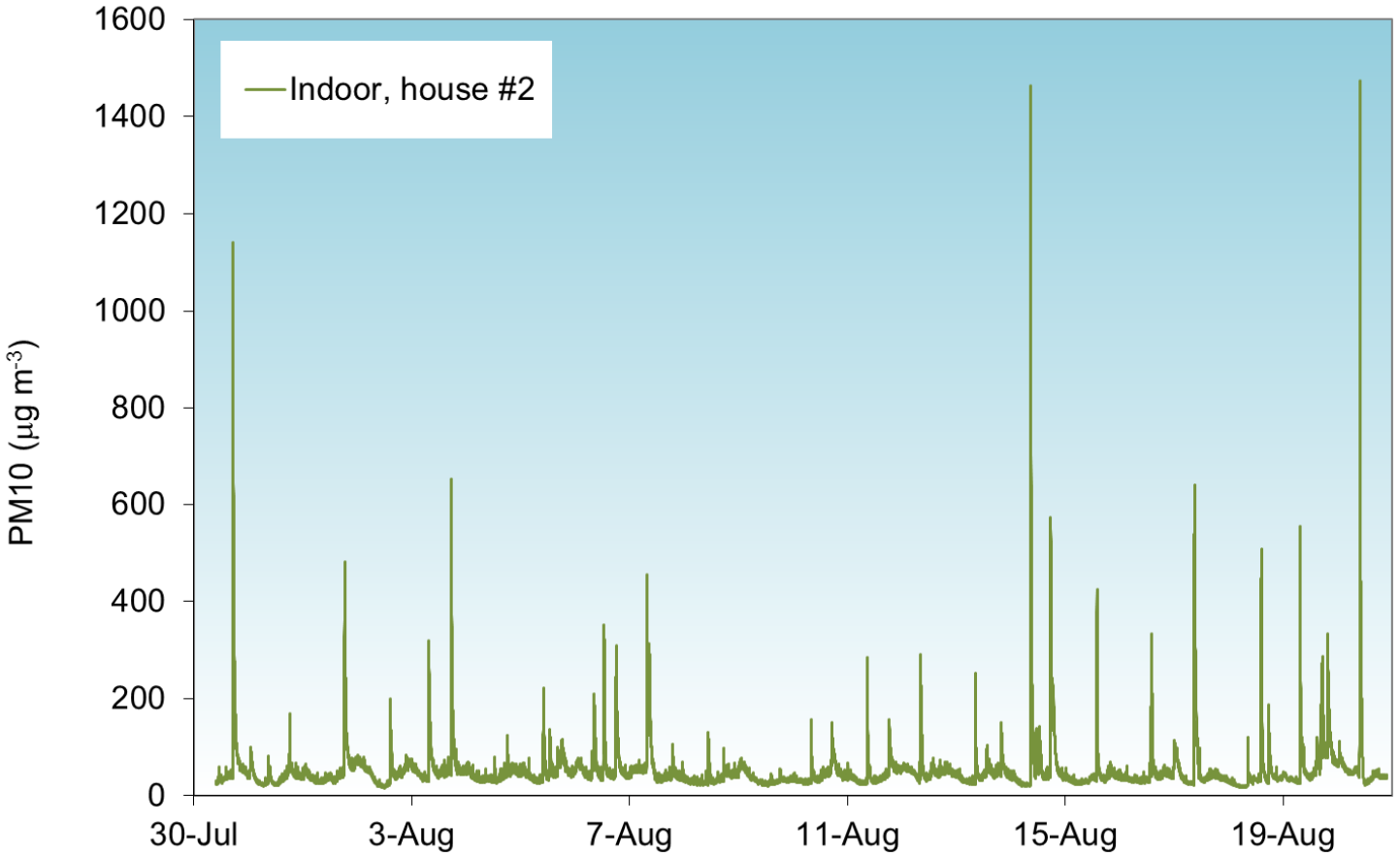
General pattern at House #2



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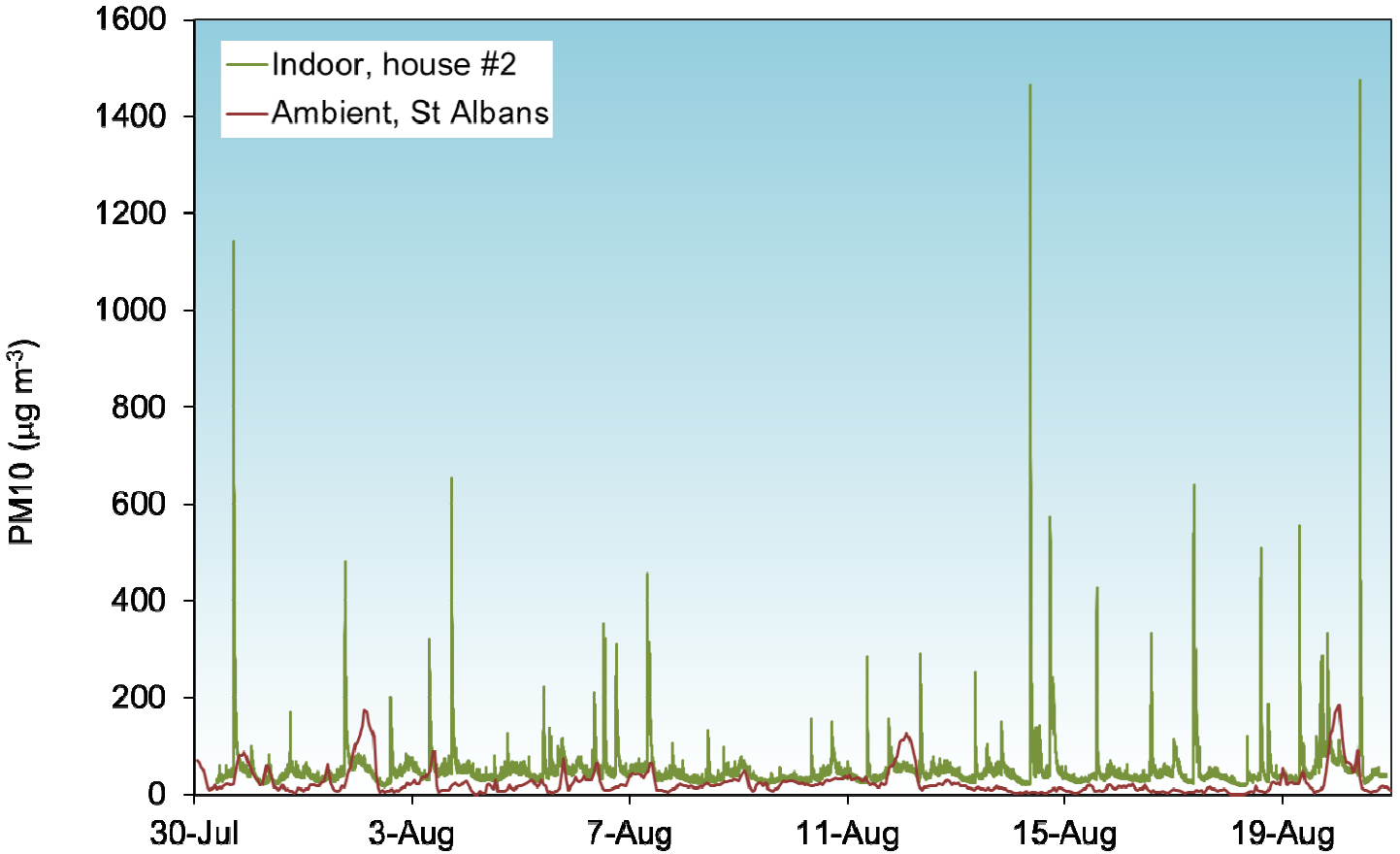
Compared to ambient



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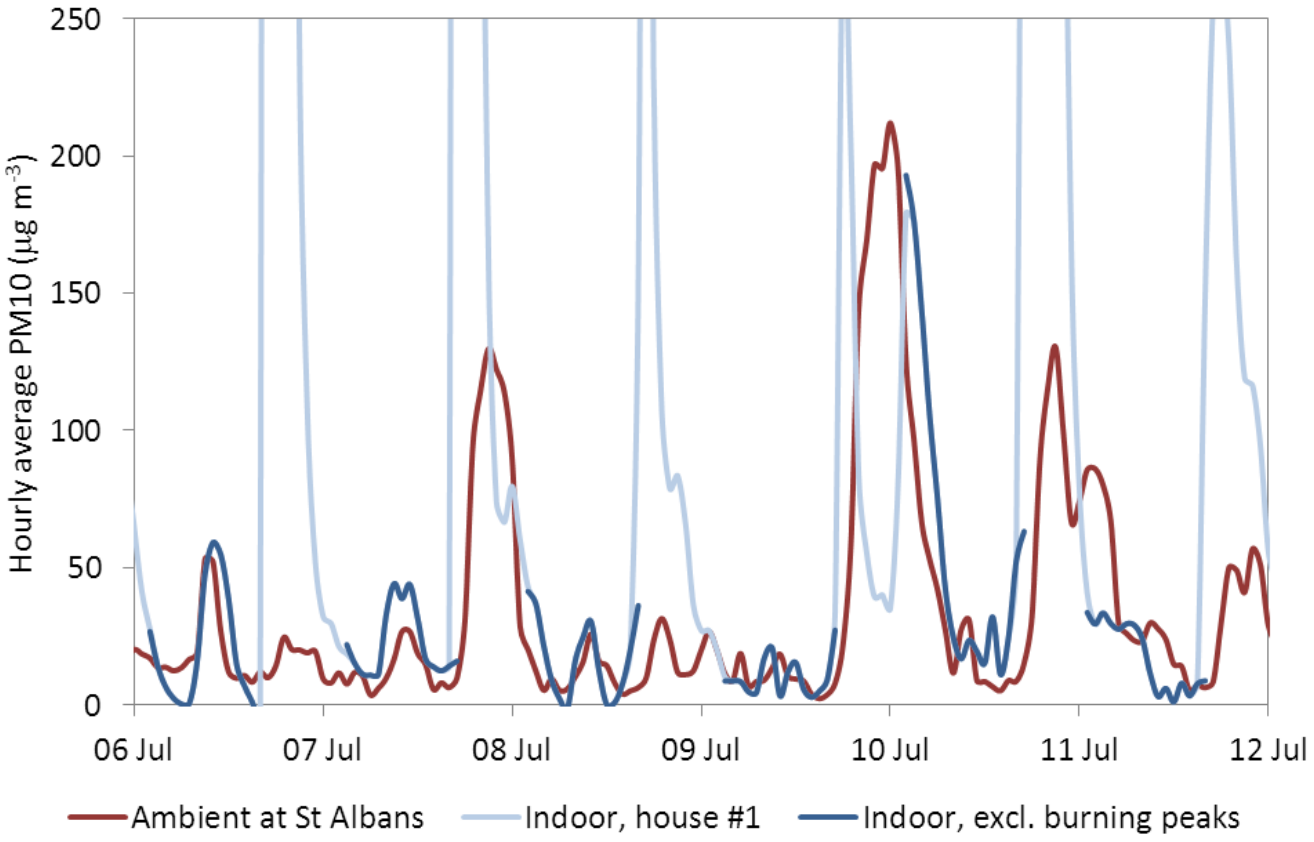
Analysis of Baseline, house #1



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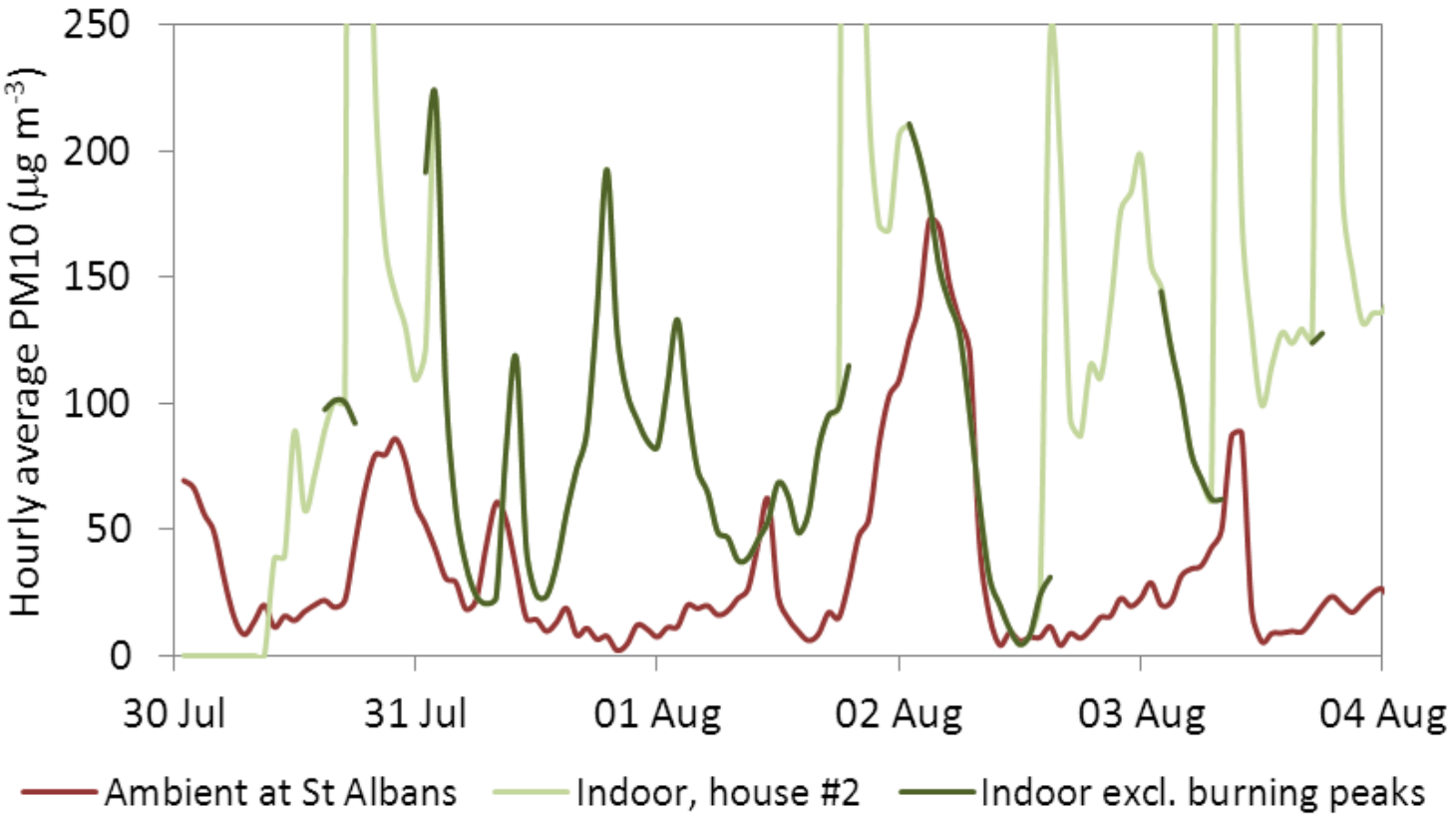
Analysis of Baseline, house #2



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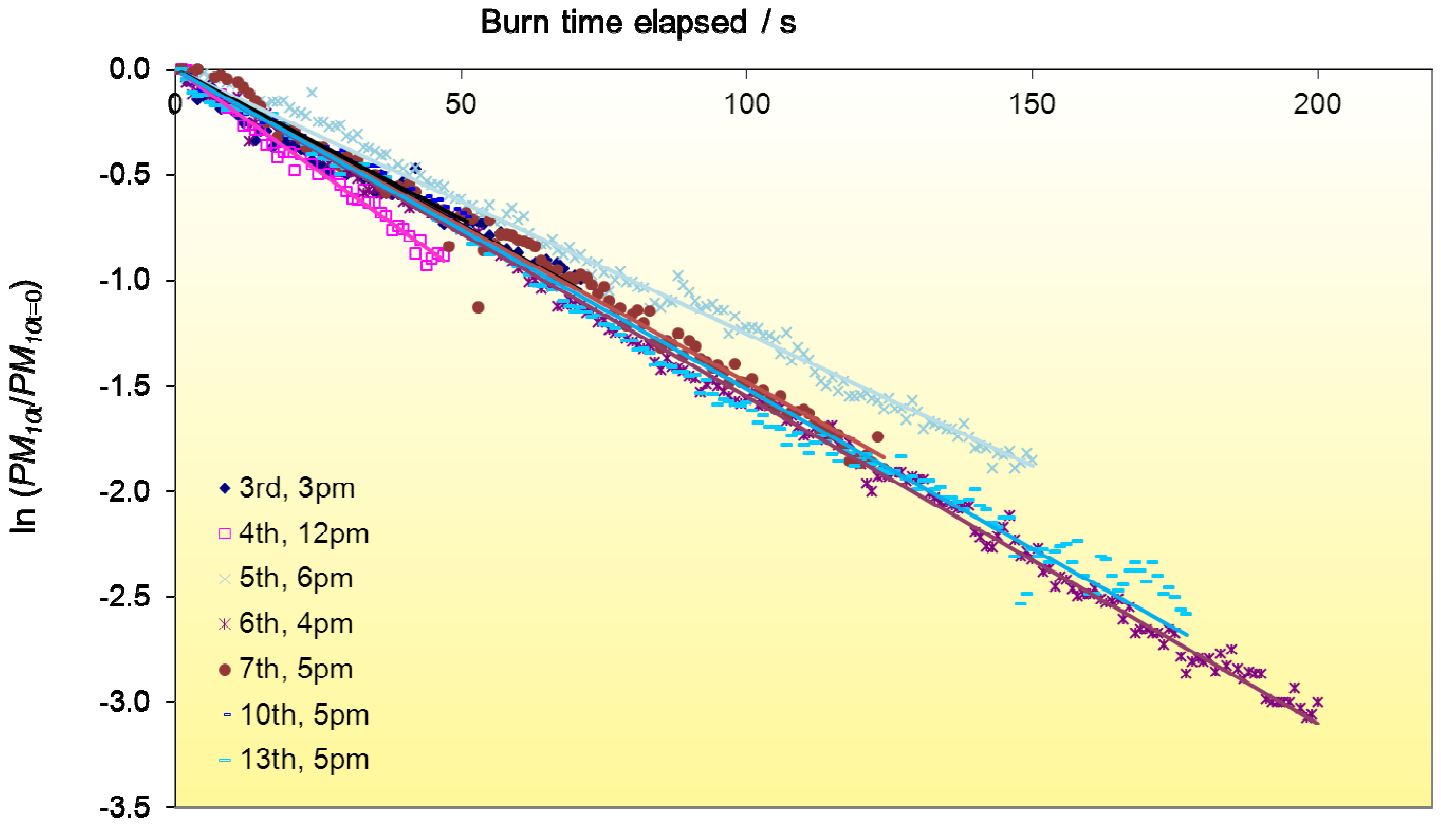
Decay Curves



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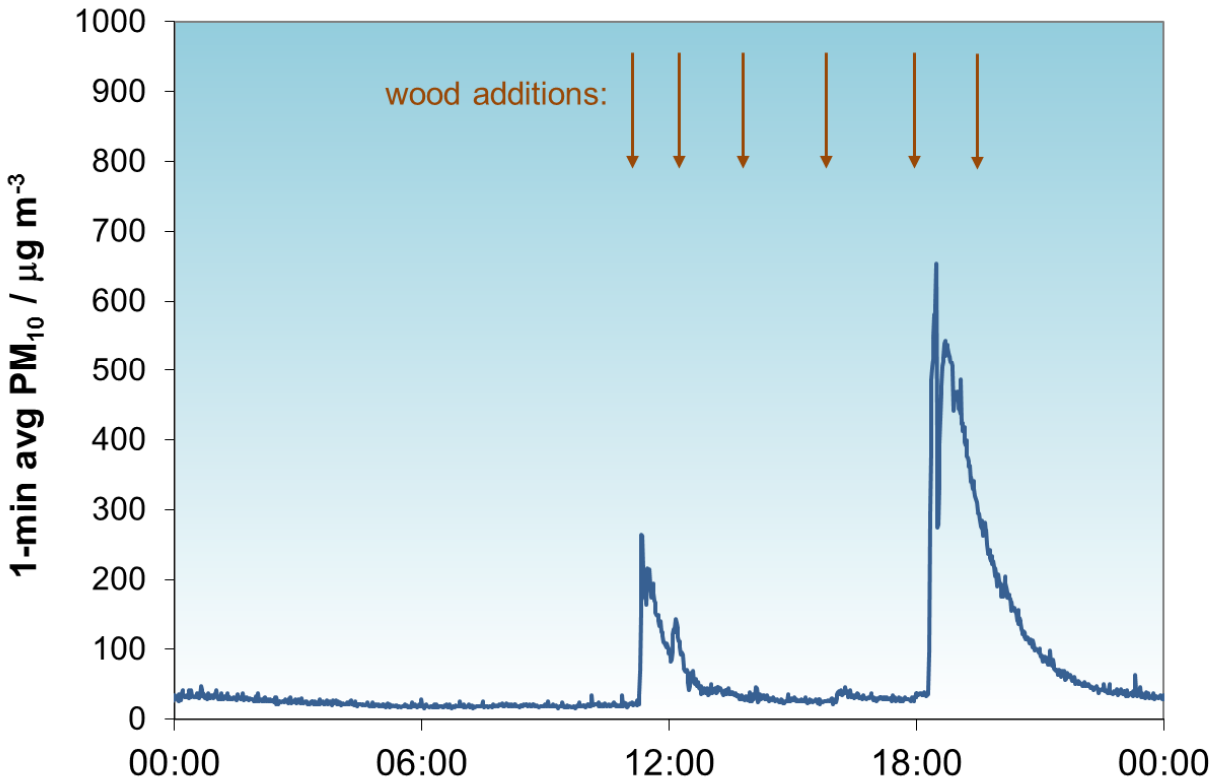
What causes the peaks?



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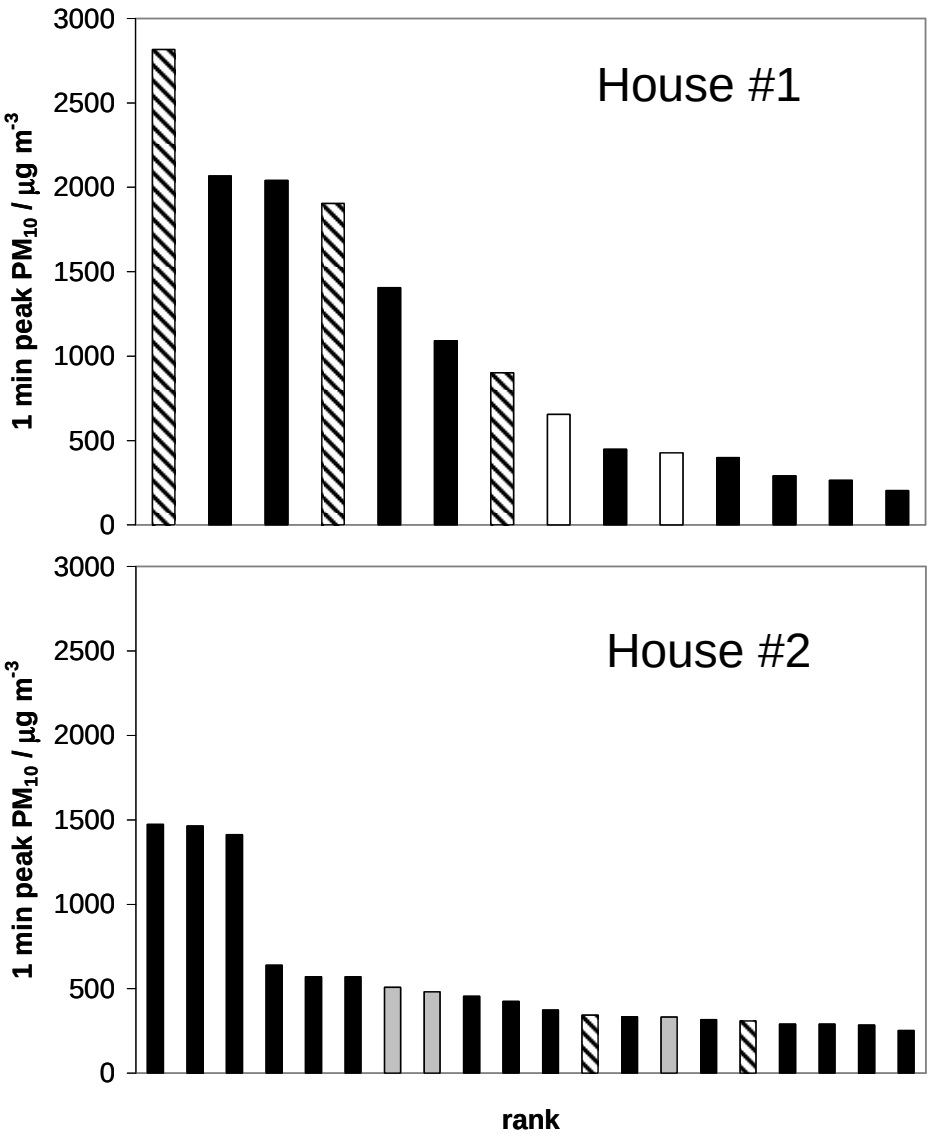
What causes the peaks?



Fire-starting

Wood added

Paper added

No cause identified

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Follow-up study

Test	Process	Maximum 1-min average PM10 (µg m^{-3})
1	“Normal” lighting: match, firelighter, kindling; firedoor slightly ajar at times	130
2	“Normal” lighting: match, firelighter, kindling; firedoor slightly ajar at times	590
3	Match only lit then place in firebox (no wood)	120
4	Match & newspaper only lit then place in firebox (no wood)	110
5	“Careful” lighting: match (lit inside firebox), firelighter, kindling; firedoor closed as much as possible	25
6	Match & newspaper only lit, allowed to smoke, then placed in firebox (no wood)	1050

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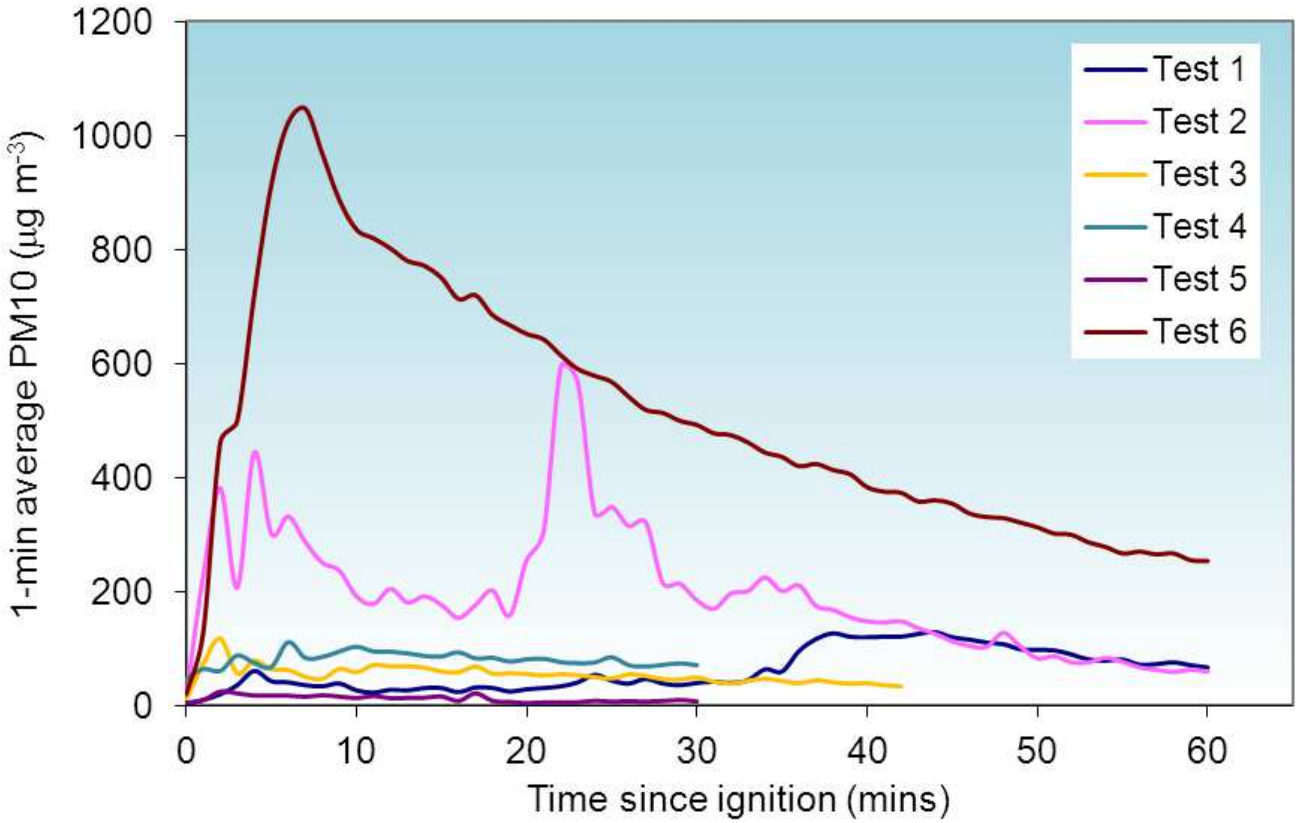
Follow-up study



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Conclusions

- 24-hr mean indoor PM_{10} 3 - 10 times ambient in wood-burning home
- Presence of wood-burner is major confounder of ambient-indoor relationship
- Determinants of indoor PM:
  1. Fire-lighting procedure/technique/materials
  2. Rate of decay (removal)
  3. Ambient PM
- Is it woodsmoke?

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